# CP- GMOs- Nirmal

## 1NC

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#### Student activists use free speech label to protect activism against genetically modified organisms- that hurts GMO development in developing nations

**Kelly 16** [Kelly, Julie. “Research on the vitamin-fortified fruit could help malnourished Africans, but well-fed collegians at Iowa State University want no part.” The Memorial Union at Iowa State University. March 14, 2016. The Wall Street Journal. https://www.wsj.com/articles/anti-gmo-students-bruise-a-superbanana-1457998345] NB

Student activists at Iowa State University are up in arms after researchers offered to pay them almost a thousand bucks to eat some genetically modified banana. The bananas, created by an Australian scientist, contain high levels of beta carotene, which converts to vitamin A when eaten. Vitamin A deficiency, which can cause blindness, stunting and even death, is a devastating problem throughout the developing world. In Uganda roughly 40% of children under age 5 are vitamin-A deficient, according to a 2011 health survey. The hope is that fortified superbananas could help prevent such malnutrition. To test their efficacy, Iowa State students were offered $900 to eat the bananas for four days during three trial periods, then have their blood tested to measure vitamin absorption. The research is led by ISU professor Wendy White, an expert on vitamin A-enriched crops. But some of the healthy, well-fed college students in America’s heartland were outraged. In February they delivered a petition with more than 57,000 signatures to the university to oppose the so-called human feeding trials. The petition was also delivered to the Seattle headquarters of the Bill and Melinda Gates Foundation, which is investing more than $2 billion to improve agriculture in the developing world, including through the banana project. “While we can all support the rights of Ugandans to have access to safe, nutritious, and culturally appropriate food, Ugandans have expressed increasing concern that genetically-modifying bananas are not meant to serve that purpose,” a group of students wrote in the Ames Tribune. “Instead, many suspect the GM bananas to be an attempt to corporately capture the domestic seed market.” They sound like they’re trying to save an organic garden in Berkeley. “Those students are acting out of ignorance,” Jerome Kubiriba, the head of the National Banana Research Program in Uganda, tells me. “It’s one thing to read about malnutrition; it’s another to have a child who is constantly falling sick yet, due to limited resources, the child cannot get immediate and constant medical care. If they knew the truth about the need for vitamin A and other nutrients for children in Uganda and Africa, they’d get a change of heart.”¶ He’s more optimistic than I am. Genetically engineered crops are anathema to the far left. An article last year in the Ecologist called the fortified bananas “a globe-trotting case of biopiracy,” and said the project’s secret ambition is profit—“to enter the international banana trade, setting itself up as the United Fruit of the 21st Century.” A field-trial in Uganda of a different genetically modified banana, one designed to resist wilt, is protected by barbed-wire fences and security guards. Three years ago in the Philippines anti-GMO protesters destroyed fields of vitamin A-enhanced Golden Rice.¶ Prof. White insists that the ISU study will go on—despite protests to deny the advances of biotechnology to the people who need it most. “It would be great to see small farmers in Africa benefit from genetic engineering technology specific to their customary crops, such as cassava and banana,” says Kevin Folta, a plant geneticist at the University of Florida. “Solutions exist, but are slow to deploy, and much of that comes from resistance borne in the industrialized world.”¶ For any lucky American college student to take part in that resistance is, well, bananas.¶

#### Millenials oppose GMOs- they aren’t scientifically backed though

**Singal 16** [ Jesse Singal, 12-8-2016, "Millennials Have Bad Views on GMOs," Science of Us, <http://nymag.com/scienceofus/2016/12/millennials-have-bad-views-on-gmos.html>] NB

It’s important not to fall into the many lazy story lines about millennials being [coddled](http://nymag.com/scienceofus/2015/11/myth-of-the-fragile-college-student.html" \t "_blank) or [oversensitive](http://nymag.com/scienceofus/2015/09/microaggression-complaints-and-victimhood.html" \t "_blank) or [anti-free-speech](http://nymag.com/scienceofus/2015/11/false-alarm-on-millennials-and-free-speech.html" \t "_blank) or [wildly promiscuous](http://nymag.com/scienceofus/2015/08/has-tinder-really-sparked-a-dating-apocalypse.html" \t "_blank) or whatever else. One shouldn’t ever make generalizations about a whole generation, and the generalizations made about millennials, coming as they are in the age of the outrage-inducing hot take and a fair amount of economic turmoil that can mask complexity — “Millennials keep moving back home!” Yeah, because they can’t find decent-paying jobs — tend to be particularly dumb. So I’ll try to phrase my reaction to the data Pew Research [just released yesterday](http://www.pewresearch.org/fact-tank/2016/12/07/younger-generations-stand-out-in-their-beliefs-about-organic-gm-foods/" \t "_blank) in a measured way: Millennials have some views about what they should and shouldn’t eat that aren’t quite backed up by science. Take, for example, this chart: As the numbers show, almost half of those in the 18-to-29 age range believe genetically modified foods pose health risks. Drilling down to more specific results, a fifth and a fourth of millennials believe, respectively, that genetically modified foods will “very likely” lead to health problems or create problems for the environment. None of these beliefs reflect the consensus of scientists. On GM foods, a long-standing campaign of misinformation from some environmental activists has severely misled concerned consumers. As the headline of Will Saletan’s [must-read long article](http://www.slate.com/articles/health_and_science/science/2015/07/are_gmos_safe_yes_the_case_against_them_is_full_of_fraud_lies_and_errors.html" \t "_blank) on the subject puts it, “The war against genetically modified organisms is full of fearmongering, errors, and fraud.” GM foods are safe to eat, and while like any agricultural technology GMOs need to be deployed responsibly, they also don’t pose any unique, undue threat to the environment. (I would guess millennials are also overestimating the health benefits of eating foods marked “organic,” but at least that term has a [specific, well-defined meaning according to the federal government](http://blogs.usda.gov/2012/03/22/organic-101-what-the-usda-organic-label-means/" \t "_blank), as opposed to labels like “natural” or “all-natural” and so on, which can often be effectively meaningless, except as a [near-religious mark of symbolic purity](http://www.theatlantic.com/health/archive/2015/05/the-puritanical-approach-to-food/392030/" \t "_blank).) There’s a tiny bit of good news, at least, if you look at this chart: Younger people are significantly more likely to follow vegetarian or vegan diets, though the numbers are still quite low. Here, there’s some actual science to back up the decision, given studies showing that heavy meat consumption — particularly red meat — [is associated with an increased risk of mortality](https://www.ncbi.nlm.nih.gov/pubmed/24148709" \t "_blank). It’s unfortunate so many more millennials are hung up on GM and organic foods than on reducing their meat intake. It isn’t a mystery why: Young people are probably a lot more likely to identify as environmentalists and/or to go out of their way to explore healthy eating, and if you start hanging out with or talking to people with these interests, you’ll likely encounter a lot of loudly communicated social norms and expectations in opposition to genetically modified foods. That doesn’t mean that there are sound scientific reasons to shun GMOs, though.

#### GMO opposition influences policy and fear mongers which leads to bans in the developing world- that hurts poorer countries

**Giddings et. Al 16** [Giddings, L. Val (L. Val Giddings is a senior fellow at ITIF with three decades of experience in science and regulatory policy relating to biotechnology innovations in agriculture and biomedicine. He is also president and CEO of PrometheusAB, Inc., providing consulting services on biotechnology issues to governments, multilateral organizations, and industry clients. Before founding PrometheusAB, he served eight years as vice president for food & agriculture of the Biotechnology Industry Organization (BIO) and a decade as a regulatory official with the U.S. Department of Agriculture. Giddings received his Ph.D. in genetics and evolutionary biology from the University of Hawaii in 1980. ). Atkinson, Robert D (Robert D. Atkinson is the founder and president of the Information Technology and Innovation Foundation. He is also the co-author of the book Innovation Economics: The Race for Global Advantage (Yale, 2012). Atkinson received his Ph.D. in City and Regional Planning from the University of North Carolina at Chapel Hill in 1989. ). Wu, J.John(J. John Wu joined ITIF in September 2015 as an economic research assistant. Prior to this, he graduated from The College of Wooster with a Bachelor of Arts in economics and sociology, with a minor in environmental studies. His research interests include green technologies, labor economics, and time use. ). Feburary 2016. “Suppressing Growth: How GMO Opposition Hurts Developing Nations” ITIF. Information Technology & Innovation Foundation. The Information Technology and Innovation Foundation (ITIF) is a nonprofit, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as one of the world’s leading science and technology think tanks, ITIF’s mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress. ] NB

Campaigns against genetically modified organisms (GMOs), originating primarily in Europe, have created significant obstacles to the development and adoption of genetically modified crops. While the policies and practices resulting from these campaigns impose considerable costs on the economies of origin, they disproportionately hurt those nations with the greatest need for more productive agriculture—particularly the developing nations of sub-Saharan Africa. The Information Technology and Innovation Foundation (ITIF) estimates that the current restrictive climate for agricultural biotech innovations could cost low- and lower- middle-income nations up to $1.5 trillion in foregone economic benefits through 2050. In short, anti-GMO activists have erected significant barriers to the development of the poorest nations on earth. Over the past three decades, a number of campaign groups have pressed successfully for restrictions or bans on the growth or import of crops and foods improved through biotechnology. Most recently, in October 2015, 19 European countries announced bans on growing GM crops, despite strong opposition from the scientific community.1 These restrictions lower farmers’ productivity and raise food prices—not just in the countries where the campaigns originate, but in nations that avoid GMO crops so they can export to countries with policies banning or limiting GMOs. Experience and data show that crops improved through biotechnology provide significant benefits for farmers, and Restrictions on biotech crops slow the growth of agricultural productivity. This is particularly acute in low-income nations where farmers have less ability to mechanize production and where biotech-improved seeds offer a low-priced way to boost yields and rural incomes.2 In sub-Saharan Africa, for example, annual farm household income in 2012 was approximately $3,000.3 Opponents of agricultural biotechnology initially argued that GMOs would benefit only industrialized nations, and would price farmers from developing nations out of the market. These largely left-of-center opponents could thus oppose innovation without inviting the charge that they were hurting the very people they claimed to be concerned about. But the opponents were wrong: GM seeds are even more important for farmers in developing countries than in developed nations, because the former could often ill afford other innovations that boost productivity (e.g., modern tractors, etc.), but they can afford improved seeds. This is why farmers in developing nations plant more biotech-improved seeds than farmers in industrial nations, despite massive European and advocacy group efforts to discourage them.4 Two decades of concerted efforts led by European countries, multinational organizations like the United Nations UNEP/GEF Global Project For Development of National Biosafety Frameworks, and anti-GMO advocacy groups have denied the benefits of agricultural biotechnology and suppressed its diffusion. If not for this, the level of adoption in developing countries, particularly in Africa, which has closer trading ties with Europe, would no doubt be far higher, given the current adoption rate of GMO seeds wherever farmers do not fear export limitations. This report documents how anti-GMO rules and policies work to perpetuate underdevelopment and poverty in developing economies.

#### Anti-GMO groups target university professors to release research- that hinders efforts to develop better GM

**Kloor 15** [Kloor Keith (NYC based journalist, adjunct professor of journalism at4 New York University, His work has appeared in Slate, Science, Discover, and the Washington Post magazine, among other outlets)w 2-13-2015, "Why Did Anti-GMO Group Target Certain University Academics?," Collide-a-Scape, <http://blogs.discovermagazine.com/collideascape/2015/02/13/anti-gmo-group-target-certain-university-academics/#.WNHE_xIrLrc>] NB

In the current issue of Science, I [report](http://news.sciencemag.org/scientific-community/2015/02/agricultural-researchers-rattled-demands-documents-group-opposed-gm" \t "_blank) that a dozen university academics recently received freedom of information requests from a non-profit group opposed to genetically modified (GM) products. Why were these 12 scientists selected? In my piece, I write: The group, U.S. Right to Know (USRTK) of Oakland, California, says it has no vendetta. It has targeted only researchers who have written articles posted on GMO Answers, a website backed by food and biotechnology firms, and work in states with laws that require public institutions to share many internal documents on request, says Executive Director Gary Ruskin. USRTK is interested in documenting links between universities and business, he says, and is “especially looking to learn how these faculty members have been appropriated into the PR machine for the chemical-agro industry.” A statement issued by Ruskin after my piece appeared reiterates what he told me in an interview. The headline of his [press release](http://usrtk.org/gmo/u-s-right-to-know-foias-profs-who-wrote-for-gmo-pr-website/" \t "_blank): “US Right to Know FOIAs Profs Who Wrote For GMO PR Website” But this, I have since learned, is not accurate. It turns out that a number of the professors–including four of the six researchers targeted at the University of California, Davis–have had no connection with the [GMO Answers](http://gmoanswers.com/" \t "_blank) website. I mentioned this to Ruskin via email today, and he quickly wrote back: “You are correct and I am sorry. My fault.” I asked him why he chose those four researchers, if they had nothing to do with the website. He responded with links to two articles ([here](http://www.eatdrinkpolitics.com/2012/10/03/did-monsato-write-this-op-ed-signed-by-a-uc-davis-professor/" \t "_blank) and [here](http://www.noprop37.com/wp-content/uploads/2014/09/Alston-Sumner-Prop-37-review.pdf" \t "_blank)) that show some of the UC Davis academics speaking out and writing on California’s 2012 [GMO labeling proposition](http://ballotpedia.org/California_Proposition_37,_Mandatory_Labeling_of_Genetically_Engineered_Food_(2012)" \t "_blank). (It was defeated.) Shortly after my story was published, some biotech scientists expressed free speech concerns. At the Biofortified site, Karl Haro von Mogel, a research geneticist at the University of Wisconsin, Madison, [writes](http://www.biofortified.org/2015/02/usrtk-wants-the-emails-of-public-scientists/" \t "_blank) that these FOIA requests risk violating academic freedom and have a silencing effect on scientist-communicators who fear becoming political targets.

#### GM crops are key to food security—they reduce food waste and increase crop yields

Hall 16

Kate Hall (managing director of the Council for Biotechnology Information and GMO Answers spokesperson). “How GMOs Help Us Reduce Food Waste & Its Environmental Impact.” Forbes. November 18th, 2016. <http://www.forbes.com/sites/gmoanswers/2016/11/18/gmos-help-reduce-food-waste/#6191a93b6546>

Producing enough food to meet the needs of a growing global population, while limiting our impact on the environment is undoubtedly one of the biggest challenges of our time. Reducing food loss and waste is and will continue to be a critical part of the solution. Today, we produce more than enough food to feed everyone on the planet, but nearly 800 million people around the world still suffer from hunger. Why? One of the reasons, according to the United Nations Food and Agriculture Organization (FAO), is that one third of food produced for human consumption globally – approximately 2.9 trillion pounds per year – is lost or wasted. Food waste also has serious environmental implications beyond just the enormous waste of water, energy, land and other resources that go into producing it. The Environmental Protection Agency (EPA) estimates that in the United States, food is the single biggest category of waste in landfills, where it rots and produces methane, a greenhouse gas with 21 times the global warming potential of carbon dioxide. To put it in perspective, approximately 31%, or 133 billion pounds, of the U.S. food supply is wasted annually, contributing to 18% of the total methane emissions that comes from landfills. The scope of the problem is enormous, but what many people may not realize is that GM crops can help tip the scales by reducing unnecessary food waste and helping farmers minimize crop loss while conserving resources by allowing them to grow more food using less land. To understand the role that GMOs can play a role in improving food security and sustainability in our global food system, it’s worth taking a closer look at some of the key culprits behind food waste and loss. The Aesthetic Dilemma Unfortunately, the unrealistic standards of beauty and cosmetic perfection that has become pervasive in many aspects of our culture also extends to our relationship with food. We have come to expect and accept only perfect looking fruits and vegetables, and as a result, enormous quantities of fresh produce go to waste each year. According to the FAO, almost half of all the fruit and vegetables produced are wasted. GMOs have enabled farmers to grow crops that are resistant to some of the minor cosmetic issues that cause consumers and retailers to discard billions of pounds of healthful food each year. Using biotechnology, we now have GM apples that have been approved for consumption that are non-browning and non-bruising, eliminating the cosmetic issues that often cause people to throw them away. There are also GM potatoes that are also less prone to browning, bruising and black spots, meaning fewer will end up in landfills. Crop Loss In the U.S. an estimated 20 to 25% of all crops are lost due to weeds, pests, crop diseases and other causes of post-harvest losses. In the developing world, it’s even worse with 40 to 50% of all crops lost. GMOs help farmers increase yields by protecting crops that would otherwise be lost due to these issues, as well as extreme weather conditions, such as droughts. In developing countries, where resources to effectively control weeds and insects are often limited, GM traits, such as insect resistance and herbicide tolerance, have increased yield substantially. A recent study published by PG Economics showed that from 1996 to 2014, crop biotechnology was responsible for increasing global production of soybeans by almost 175 million tons, corn by almost 355 million tons, cotton by 27 million tons and canola by 10 million tons. GM traits can also help farmers produce crops that are more resistant to extreme weather conditions. In recent years, several extreme weather disasters around the world have significantly damaged regional crop production. A recent study, published in the journal Nature, found that drought and extreme heat reduced crop yields by as much as 10% between 1964 and 2007. They also observed approximately 7% greater production damage from more recent droughts and up to 11% more damage in developed countries than in developing ones. Today, through advances in crop biotechnology, GMOs like drought tolerant corn can help farmers minimize losses associated with extreme weather events.

#### GM crops are key to stabilizing and increasing food supplies—that solves food price spikes

**Qaim and Kouser 13**

Matin Qaim (Department of Agricultural Economics and Rural Development, Georg-August-University of Goettingen, Goettingen, Germany) and Shahzad Kouser (Institute of Agricultural and Resource Economics, University of Agriculture, Faisalabad, Pakistan). “Genetically Modified Crops and Food Security.” PLoS One. 2013. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3674000/

There are three possible pathways how GM crops could impact food security. First, GM crops could contribute to food production increases and thus improve the availability of food at global and local levels. Second, GM crops could affect food safety and food quality. Third, GM crops could influence the economic and social situation of farmers, thus improving or worsening their economic access to food. This latter aspect is of particular importance given that an estimated 50% of all undernourished people worldwide are small-scale farmers in developing countries [7]. In regard to the first pathway, GM technologies could make food crops higher yielding and more robust to biotic and abiotic stresses [8], [9]. This could stabilize and increase food supplies, which is important against the background of increasing food demand, climate change, and land and water scarcity. In 2012, 170 million hectares (ha) – around 12% of the global arable land – were planted with GM crops, such as soybean, corn, cotton, and canola [10], but most of these crops were not grown primarily for direct food use. While agricultural commodity prices would be higher without the productivity gains from GM technology [11], impacts on food availability could be bigger if more GM food crops were commercialized. Lack of public acceptance is one of the main reasons why this has not yet happened more widely [12]. Concerning the second pathway, crops with new traits can be associated with food safety risks, which have to be assessed and managed case by case. But such risks are not specific to GM crops. Long-term research confirms that GM technology is not per se more risky than conventional plant breeding technologies [13]. On the other hand, GM technology can help to breed food crops with higher contents of micronutrients; a case in point is Golden Rice with provitamin A in the grain [14]. Such GM crops have not yet been commercialized. Projections show that they could reduce nutritional deficiencies among the poor, entailing sizeable positive health effects [15], [16]. The third pathway relates to GM crop use by smallholder farmers in developing countries. Half of the global GM crop area is located in developing countries, but much of this refers to large farms in countries of South America. One notable exception is Bacillus thuringiensis (Bt) cotton, which is grown by around 15 million smallholders in India, China, Pakistan, and a few other developing countries [10]. Bt cotton provides resistance to important insect pests, especially cotton bollworms. Several studies have shown that Bt cotton adoption reduces chemical pesticide use and increases yields in farmers’ fields [17]–[20]. There are also a few studies that have shown that these benefits are associated with increases in farm household income and living standard [21]–[23]. Higher incomes are generally expected to cause increases in food consumption in poor farm households. On the other hand, cotton is a non-food cash crop, so that the nutrition impact is uncertain. Here we address this question and analyze the impact of Bt cotton adoption on calorie consumption and dietary quality in India. Bt cotton was first commercialized in India in 2002. In 2012, over 7 million farmers had adopted this technology on 10.8 million ha – equivalent to 93% of the country’s total cotton area [10]. For the analysis, we carried out a household survey and collected comprehensive data over a period of several years. This is the first ex post study that analyzes food security effects of Bt cotton or any other GM crop with micro level data.

**Food insecurity causes extinction**

**Trudell 5**

Robert H., Fall, Trudell,  J.D. Candidate 2006, Food Security Emergencies And The Power Of Eminent Domain: A Domestic Legal Tool To Treat A Global Problem, 33 Syracuse J. Int'l L. & Com. 277, Lexis

2. But, Is It Really an Emergency?  In his study on environmental change and security, J.R. McNeill dismisses the scenario where environmental degradation destabilizes an area so much that "security problems and ... resource scarcity may lead to war." 101 McNeill finds such a proposition to be a weak one, largely because history has shown society is always able to stay ahead of widespread calamity due, in part, to the slow pace of any major environmental change. 102 This may be so. However, as the events in Rwanda illustrated, the environment can breakdown quite rapidly - almost before one's eyes - when food insecurity drives people to overextend their cropland and to use outmoded agricultural practices. 103 Furthermore, as Andre and Platteau documented in their study of Rwandan society, overpopulation and land scarcity can contribute to a breakdown of society itself. 104  Mr. McNeill's assertion closely resembles those of many critics of Malthus. 105 The general argument is: whatever issue we face (e.g., environmental change or overpopulation), it will be introduced at such a pace that we can face the problem long before any calamity sets in. 106  This wait-and-see view relies on many factors, not least of which are a functioning society and innovations in agricultural productivity. But, today, with up to 300,000 child soldiers fighting in conflicts or wars, and perpetrating terrorist acts, **the very fabric** of society is under increasing world-wide pressure. 107 Genocide, anarchy, dictatorships, and war are endemic throughout Africa; it is a troubled continent whose problems threaten global security and challenge **all of humanity**. 108 As  [\*292]  Juan Somavia, secretary general of the World Social Summit, said: "We've replaced the threat of the nuclear bomb with the threat of a social bomb." 109 Food insecurity is part of the fuse burning to set that bomb off. It is an emergency and we must put that fuse out before it is too late.

#### Turns war and instability

**Hendrix 16**

Dr. Cullen Hendrix (Associate Professor at the Sié ChéouKang Center for International Security and Diplomacy at the Korbel School at the University of Denver; Nonresident Senior Fellow at the Peterson Institute for International Economics in Washington, DC; and Senior Research Advisor at the Center for Climate & Security, also in Washington, DC). “When Hunger Strikes: How Food Security Abroad Matters for National Security at Home.” The Chicago Council on Global Affairs. April 2016. https://www.thechicagocouncil.org/sites/default/files/Report\_When\_Hunger\_Strikes\_1604.pdf

More than half of the world’s poorest people work as farmers in low-income countries, and growing their incomes and yields is twice as effective at reducing poverty as investment in other sectors.6 US investments in agricultural research and development programs such as Feed the Future, a US program to advance food security overseas, have begun to see strong gains in agricultural productivity and reductions in rates of child undernutrition, among other crucial outcomes.7 However, with a burgeoning global population expected to surpass 9 billion by 2050, an increasingly volatile climate, and rapid urbanization, the task of ensuring that our food system is abundant, nutritious, and stable has never been more important. This brief explores one potent outcome of the consequences of high food prices and food insecurity: political instability. Alongside the recommendations suggested, broader development initiatives are central to mitigating protracted and pervasive global food insecurity. High food prices exacerbate food insecurity, leading to political instability Recent events demonstrate how high the stakes remain. Following a 20-year period of relative stability in world food markets, extreme price volatility marked the 2000s, particularly the period from 2007 to the present (see Figure 1, “Food prices and food-related protests, 1990–2015”). From 2007 to 2011, high food prices swelled the ranks of the world’s food insecure, with women and children most acutely affected. Since then, the number of food-insecure people has trended downward—thanks in large part to lower prices and increased agriculture investment by governments, the private sector, and nonprofits. However, we can ill afford to be complacent about prospects going forward, as food insecurity is expected to deepen in key regions if the current trajectory holds. The social and economic costs of these food price spikes were considerable, however the political fallout—as well as the relationship between food and political stability it highlights—was just as damaging. Food price–related protests, also in Figure 1, toppled governments in Haiti and Madagascar in 2007–08. And in 2010–11, food prices and food insecurity were again implicated in the political turmoil and mass uprisings of the Arab Spring. These movements did not all begin violently, but once protesters were mobilized, heavy-handed government responses often led otherwise peaceful protests to become violent and destabilizing. In both periods, countries of high strategic significance to the United States were affected (see Figure 2, “Food riots 2007–11 and current oil exports”). The unrest in the Middle East and North Africa roiled energy markets: more than 20 percent of world crude and petroleum exports pass through either the Suez Canal or the Strait of Hormuz, and both were ringed by countries experiencing unrest.9 Though oil flows through those channels were not disrupted, unrest in Libya and concern that the Arab Spring would spread to major Gulf oil exporters (Kuwait, Saudi Arabia, and the United Arab Emirates) pushed already high oil prices up by 15 percent in late February and early March 2011.10 The resulting instability strained Egyptian relations with Israel and necessitated a NATO intervention in Libya. The ongoing civil war in Syria—which can be linked to drought, food insecurity, rapid urbanization, and exclusionary rule (see Box 1, “Important terms”)—is exacting a massive toll and contributing to growing tensions with Russia, dissention over refugee resettlement among NATO partners in Europe, and the escalation of a serious threat to the Iraqi government. Closer to US borders, soaring prices for staples like rice and beans in Haiti led to a week of rioting in 2008 during which five people were killed, with the violence involving both Haitian police and UN Peacekeepers. Moreover, rising food prices and deteriorating economic prospects there fueled attempts to immigrate to the United States. As food prices shot up almost 20 percent in 2007, US Coast Guard interdictions of Haitians rose 34 percent, straining US Coast Guard resources.11 Thus the food riots of 2007–11 offer very clear examples of how food insecurity and grievances over high prices abroad affect US national security at home and stress national security resources.

## 2NC

### Extra Impact Cards

#### GM crops solve extinction

Trewavas 2k

Anthony, Institute of Cell and Molecular Biology – University of Edinburgh, “GM Is the Best Option We Have”, AgBioWorld, 6-5, <http://www.agbioworld.org/biotech-info/articles/biotech-art/best_option.html>

There are some Western critics who oppose any solution to world problems involving technological progress. They denigrate this remarkable achievement. These luddite individuals found in some Aid organisations instead attempt to impose their primitivist western views on those countries where blindness and child death are common. This new form of Western cultural domination or neo-colonialism, because such it is, should be repelled by all those of good will. Those who stand to benefit in the third world will then be enabled to make their own choice freely about what they want for their own children. But these are foreign examples; global warming is the problem that requires the UK to develop GM technology. 1998 was the warmest year in the last one thousand years. Many think global warming will simply lead to a wetter climate and be benign. I do not. Excess rainfall in northern seas has been predicted to halt the Gulf Stream. In this situation, average UK temperatures would fall by 5 degrees centigrade and give us Moscow-like winters. There are already worrying signs of salinity changes in the deep oceans. Agriculture would be seriously damaged and necessitate the rapid development of new crop varieties to secure our food supply. We would not have much warning. Recent detailed analyses of arctic ice cores has shown that the climate can switch between stable states in fractions of a decade. Even if the climate is only wetter and warmer new crop pests and rampant disease will be the consequence. GM technology can enable new crops to be constructed in months and to be in the fields within a few years. This is the unique benefit GM offers. The UK populace needs to much more positive about GM or we may pay a very heavy price. In 535A.D. a volcano near the present Krakatoa exploded with the force of 200 million Hiroshima A bombs. The dense cloud of dust so reduced the intensity of the sun that for at least two years thereafter, summer turned to winter and crops here and elsewhere in the Northern hemisphere failed completely. The population survived by hunting a rapidly vanishing population of edible animals. The after-effects continued for a decade and human history was changed irreversibly. But the planet recovered. Such examples of benign nature's wisdom, in full flood as it were, dwarf and make miniscule the tiny modifications we make upon our environment. There are apparently 100 such volcanoes round the world that could at any time unleash forces as great. And even smaller volcanic explosions change our climate and can easily threaten the security of our food supply. Our hold on this planet is tenuous. In the present day an equivalent 535A.D. explosion would destroy much of our civilisation. Only those with agricultural technology sufficiently advanced would have a chance at survival. Colliding asteroids are another problem that requires us to be forward-looking accepting that technological advance may be the only buffer between us and annihilation.

### More Data

#### GMOs are key to food security—studies and empirics disprove negative effects

Rotman ’13 (David Rotman, Editor of MIT Technology Review, “Why We Will Need Genetically Modified Foods”, <http://www.technologyreview.com/featuredstory/522596/why-we-will-need-genetically-modified-foods/page/5/>, December 17, 2013)

Climate change will make it increasingly difficult to feed the world. Biotech crops will have an essential role in ensuring that there’s enough to eat. Signs of late blight appear suddenly but predictably in Ireland as soon as the summer weather turns humid, spores of the funguslike plant pathogen wafting across the open green fields and landing on the wet leaves of the potato plants. This year it began to rain in early August. Within several weeks, late blight had attacked a small plot of potatoes in the corner of the neat grid of test plantings at the headquarters of Teagasc, Ireland’s agricultural agency, in Carlow. It’s now more than a month after the potato plants were first struck and still a few weeks before the crop will be harvested. A large country house, housing the operations of Teagasc, overlooks the field trials, and well-dressed Irish and EU bureaucrats hustle in and out. Much of the sprawling building was constructed in the 1800s, during the worst of the famines that were triggered when blight devastated Ireland’s potato harvest. Such famines are far in the past, but the plant disease remains a costly torment to the country’s farmers, requiring them to douse their crops frequently with fungicides. As part of an EU-wide project called Amiga to study the impact of genetically modified (GM) plants, Teagasc researcher Ewen Mullins is testing potatoes that are engineered to resist blight. (Watch a video of Mullins and GM potatoes in Ireland at the bottom of this page or here.) It’s breezy, and though the summer is over, it’s still warm and humid. “Perfect weather for blight,” says Mullins. Bending over the conventionally bred plants, he firmly pulls back the wilted stems and leaves to show that the tubers, half-exposed in the ground, are scarred with black blotches. Then he picks at a green leaf from one of the genetically engineered plants, which have been modified with a blight-resistant gene from a wild potato that grows in South America. The defenses of the potato plant have fought off the spores, rendering them harmless. The plant, says Mullins simply, “has performed well.” It’s the second year of what are scheduled to be three-year field trials. But even if the results from next year are similarly encouraging, Teagasc has no intention of giving farmers access to the plant, which was developed by researchers at Wageningen University in the Netherlands. Such genetically engineered crops remain controversial in Europe, and only two are approved for planting in the EU. Though Mullins and his colleagues are eager to learn how blight affects the GM potatoes and whether the plants will affect soil microbes, distributing the modified plant in Ireland is, at least for now, a nonstarter. Nevertheless, the fields of Carlow present a tantalizing picture of how genetically modified crops could help protect the world’s food supply. Blight-resistant potatoes would be one of the first major foods genetically engineered to incorporate defenses against plant diseases, which annually destroy some 15 percent of the world’s agricultural harvest. Despite the heavy use of fungicides, late blight and other plant diseases ruin an estimated fifth of the world’s potatoes, a food increasingly grown in China and India. Stem rust, a fungal disease of wheat, has spread through much of Africa and the Arabian Peninsula and is now threatening the vast growing regions of central and south Asia, which produce some 20 percent of the world’s wheat. Bananas, which are a primary source of food in countries such as Uganda, are often destroyed by wilt disease. In all these cases, genetic engineering has the potential to create varieties that are far better able to withstand the onslaught. GM potatoes could also lead to a new generation of biotech foods sold directly to consumers. Though transgenic corn, soybeans, and cotton—mostly engineered to resist insects and herbicides—have been widely planted since the late 1990s in the United States and in a smattering of other large agricultural countries, including Brazil and Canada, the corn and soybean crops go mainly into animal feed, biofuels, and cooking oils. No genetically modified varieties of rice, wheat, or potatoes are widely grown, because opposition to such foods has discouraged investment in developing them and because seed companies haven’t found ways to make the kind of money on those crops that they do from genetically modified corn and soybeans. Drought, damaging storms, and very hot days are already taking a toll on crop yields. With the global population expected to reach more than nine billion by 2050, however, the world might soon be hungry for such varieties. Although agricultural productivity has improved dramatically over the past 50 years, economists fear that these improvements have begun to wane at a time when food demand, driven by the larger number of people and the growing appetites of wealthier populations, is expected to rise between 70 and 100 percent by midcentury. In particular, the rapid increases in rice and wheat yields that helped feed the world for decades are showing signs of slowing down, and production of cereals will need to more than double by 2050 to keep up. If the trend continues, production might be insufficient to meet demand unless we start using significantly more land, fertilizer, and water. Climate change is likely to make the problem far worse, bringing higher temperatures and, in many regions, wetter conditions that spread infestations of disease and insects into new areas. Drought, damaging storms, and very hot days are already taking a toll on crop yields, and the frequency of these events is expected to increase sharply as the climate warms. For farmers, the effects of climate change can be simply put: the weather has become far more unpredictable, and extreme weather has become far more common. The central highlands of Mexico, for example, experienced their driest and wettest years on record back to back in 2011 and 2012, says Matthew Reynolds, a wheat physiologist at the International Maize and Wheat Improvement Center in El Batán. Such variation is “worrisome and very bad for agriculture,” he says. “It’s extremely challenging to breed for it. If you have a relatively stable climate, you can breed crops with genetic characteristics that follow a certain profile of temperatures and rainfall. As soon as you get into a state of flux, it’s much more difficult to know what traits to target.” One advantage of using genetic engineering to help crops adapt to these sudden changes is that new varieties can be created quickly. Creating a potato variety through conventional breeding, for example, takes at least 15 years; producing a genetically modified one takes less than six months. Genetic modification also allows plant breeders to make more precise changes and draw from a far greater variety of genes, gleaned from the plants’ wild relatives or from different types of organisms. Plant scientists are careful to note that no magical gene can be inserted into a crop to make it drought tolerant or to increase its yield—even resistance to a disease typically requires multiple genetic changes. But many of them say genetic engineering is a versatile and essential technique. “It’s an overwhelmingly logical thing to do,” says Jonathan Jones, a scientist at the Sainsbury Laboratory in the U.K. and one of the world’s leading experts on plant diseases. The upcoming pressures on agricultural production, he says, “[are] real and will affect millions of people in poor countries.” He adds that it would be “perverse to spurn using genetic modification as a tool.” It’s a view that is widely shared by those responsible for developing tomorrow’s crop varieties. At the current level of agricultural production, there’s enough food to feed the world, says Eduardo Blumwald, a plant scientist at the University of California, Davis. But “when the population reaches nine billion?” he says. “No way, José.” Failed promises The promise that genetically modified crops could help feed the world is at least as old as the commercialization of the first transgenic seeds in the mid-1990s. The corporations that helped turn genetically engineered crops into a multibillion-dollar business, including the large chemical companies Monsanto, Bayer, and DuPont, promoted the technology as part of a life science revolution that would greatly increase food production. So far it’s turned out, for a number of reasons, to have been a somewhat empty promise. To be sure, bioengineered crops are a huge commercial success in some countries. The idea is simple but compelling: by inserting a foreign gene derived from, say, bacteria into corn, you can give the plant a trait it wouldn’t otherwise possess. Surveys estimate that more than 170 million hectares of such transgenic crops are grown worldwide. In the United States, the majority of corn, soybeans, and cotton planted have been engineered with a gene from the soil bacterium Bacillus thuringensis—Bt—to ward off insects or with another bacterial gene to withstand herbicides. Worldwide, 81 percent of the soybeans and 35 percent of the corn grown are biotech varieties. In India, Bt cotton was approved more than a decade ago and now represents 96 percent of the cotton grown in the country. Yet it’s not clear whether that boom in transgenic crops has led to increased food production or lower prices for consumers. Take corn, for example. In the United States, 76 percent of the crop is genetically modified to resist insects, and 85 percent can tolerate being sprayed with a weed killer. Such corn has, arguably, been a boon to farmers, reducing pesticide use and boosting yields. But little of U.S. corn production is used directly for human food; about 4 percent goes into high–fructose corn syrup and 1.8 percent to cereal and other foods. Genetically modified corn and soybeans are so profitable that U.S. farmers have begun substituting them for wheat: around 56 million acres of wheat were planted in 2012, down from 62 million in 2000. As supply fell, the price of a bushel of wheat rose to nearly $8 in 2012, from $2.50 in 2000. So far, the short list of transgenic crops used directly for food includes virus-resistant papaya grown in Hawaii, Bt sweet corn recently commercialized in the United States by Monsanto, and a few varieties of squash that resist plant viruses. That list could be about to grow, however. The Indonesian agricultural agency expects to approve a blight-resistant potato soon, and J. R. Simplot, an agricultural supplier based in Boise, Idaho, is hoping to commercialize its own version by 2017. Monsanto, which abandoned an attempt to develop GM wheat in 2004, bought a wheat-seed company in 2009 and is now trying again. And Cornell researchers are working with collaborators in India, Bangladesh, and the Philippines, countries where eggplant is a staple, to make an insect-resistant form of the vegetable available to farmers. Only a handful of large companies can afford the risk and expense of commercializing GMOs. These bioengineered versions of some of the world’s most important food crops could help fulfill initial hopes for genetically modified organisms, or GMOs. But they will also almost certainly heat up the debate over the technology. Opponents worry that inserting foreign genes into crops could make food dangerous or allergenic, though more than 15 years of experience with transgenic crops have revealed no health dangers, and neither have a series of scientific studies. More credibly, detractors suggest that the technology is a ploy by giant corporations, particularly Monsanto, to peddle more herbicides, dominate the agricultural supply chain, and leave farmers dependent on high-priced transgenic seeds. The most persuasive criticism, however, may simply be that existing transgenic crops have done little to guarantee the future of the world’s food supply in the face of climate change and a growing population. The first generation of insect-resistant and herbicide-tolerant crops offer few new traits, such as drought tolerance and disease resistance, that could help the plants adapt to changes in weather and disease patterns, acknowledges Margaret Smith, a professor of plant breeding and genetics at Cornell University. Nonetheless, she says there is no valid reason to dismiss the technology as plant scientists race to increase crop productivity. Scientists are “facing a daunting breeding challenge,” Smith says. “We will need a second generation of transgenic crops. It would be a mistake to rule out this tool because the first products didn’t address the big issues.” Developing crops that are better able to withstand climate change won’t be easy. It will require plant scientists to engineer complex traits involving multiple genes. Durable disease resistance typically requires a series of genetic changes and detailed knowledge of how pathogens attack the plant. Traits such as tolerance to drought and heat are even harder, since they can require basic changes to the plant’s physiology. Is genetic engineering up to the task? No one knows. But recent genomic breakthroughs are encouraging. Scientists have sequenced the genomes of crops such as rice, potatoes, bananas, and wheat. At the same time, advances in molecular biology mean that genes can be deleted, modified, and inserted with far greater precision. In particular, new genome engineering tools known as Talens and Crispr allow geneticists to “edit” plant DNA, changing chromosomes exactly where they want. Exact Edits The workshop adjacent to the rows of greenhouses at the edge of Cornell’s campus in Ithaca, New York, smells musty and damp from the crates of potatoes. It is less than a mile from the university’s molecular biology labs, but what you see are wooden conveyer belts, wire screens, and water hoses. Walter De Jong is sorting and sizing harvested potatoes as part of a multiyear effort to come up with yet a better variety for the region’s growers. Boxes are filled with potatoes—some small and round, others large and misshapen. Asked what traits are important to consumers, he smiles slyly and says, “Looks, looks, looks.” The question of how he feels about efforts to develop transgenic potatoes is not as easily answered. It’s not that De Jong is opposed to genetic engineering. As a potato breeder, he’s well versed in conventional methods of introducing new traits, but he also has a PhD in plant pathology and has done considerable research in molecular biology; he knows the opportunities that advanced genetics opens up. In the northeastern United States, a variety of potato is optimized for about a 500-mile radius, taking into account the length of the growing season and the type of weather in the area. Climate change means these growing zones are shifting, making crop breeding like solving a puzzle in which the pieces are moving around. The speed offered by genetic modification would help. But, De Jong says dismissively, “I don’t expect to use [transgenic] technology. I can’t afford it.” Cultivation of GM potatoes at Teagasc begins with a GM plantlet grown in a tissue culture (1); it is transferred to a greenhouse (2) and eventually to field trials (3). The harvested tubers appear healthy and free of blight (4). “It’s a curious situation,” he says. Scientists at public and academic research institutions have done much of the work to identify genes and understand how they can affect traits in plants. But the lengthy testing and regulatory processes for genetically modified crops, and the danger that consumers will reject them, mean that only “a handful of large companies” can afford the expense and risk of developing them, he says. But De Jong suddenly becomes animated when he’s asked about the newest genome engineering tools. “This is what I have been waiting my whole career for,” he says, throwing his hands up. “As long as I have been a potato scientist, I’ve wanted two things: a sequenced potato genome and the ability to modify the genome at will.” Across campus, De Jong also runs a molecular biology lab, where he has identified the DNA sequence responsible for red pigment in potato tubers. Soon, it could be possible to precisely alter that sequence in a potato cell that can then be grown into a plant: “If I had a white potato I wanted to turn red, I could just edit one or two nucleotides and get the color I want.” Plant breeding “is not the art of shuffling genes around,” De Jong explains. “Basically, all potatoes have the same genes; what they have is different versions of the genes—alleles. And alleles differ from one another in a few nucleotides. If I can edit the few nucleotides, why breed for [a trait]? It’s been the holy grail in plant genetics for a long time.” One problem with conventional genetic engineering techniques is that they add genes unpredictably. The desired gene is inserted into the targeted cell in a petri dish using either a plant bacterium or a “gene gun” that physically shoots a tiny particle covered with the DNA. Once the molecules are in the cell, the new gene is inserted into the chromosome randomly. (The transformed cell is grown in a tissue culture to become a plantlet and eventually a plant.) It’s impossible to control just where the gene gets added; sometimes it ends up in a spot where it can be expressed effectively, and sometimes it doesn’t. What if you could precisely target spots on the plant’s chromosome and add new genes exactly where you want them, “knock out” existing ones, or modify genes by switching a few specific nucleotides? The new tools allow scientists to do just that. Talens, one of the most promising of these genome engineering tools, was inspired by a mechanism used by a bacterium that infects plants. Plant pathologists identified the proteins that enable the bacterium to pinpoint the target plant DNA and found ways to engineer these proteins to recognize any desired sequence; then they fused these proteins with nucleases that cut DNA, creating a precise “editing” tool. A plant bacterium or gene gun is used to get the tool into the plant cell; once inside, the proteins zero in on a specific DNA sequence. The proteins deliver the nucleases to an exact spot on the chromosome, where they cleave the plant’s DNA. Repair of the broken chromosome allows new genes to be inserted or other types of modifications to be made. Crispr, an even newer version of the technology, uses RNA to zero in on the targeted genes. With both Talens and Crispr, molecular biologists can modify even a few nucleotides or insert and delete a gene exactly where they want on the chromosome, making the change far more predictable and effective. One implication of the new tools is that plants can be genetically modified without the addition of foreign genes. Though it’s too early to tell whether that will change the public debate over GMOs, regulatory agencies—at least in the United States—indicate that crops modified without foreign genes won’t have to be scrutinized as thoroughly as transgenic crops. That could greatly reduce the time and expense it takes to commercialize new varieties of genetically engineered foods. And it’s possible that critics of biotechnology could draw a similar distinction, tolerating genetically modified crops so long as they are not transgenic. Dan Voytas, director of the genome engineering center at the University of Minnesota and one of Talens’s inventors, says one of his main motivations is the need to feed another two billion people by the middle of the century. In one of his most ambitious efforts, centered at the International Rice Research Institute in Los Baños, the Philippines, he is collaborating with a worldwide network of researchers to rewrite the physiology of rice. Rice and wheat, like other grains, have what botanists call C3 photosynthesis, rather than the more complex C4 version that corn and sugarcane have. The C4 version of photosynthesis uses water and carbon dioxide far more efficiently. If the project is successful, both rice and wheat yields could be increased in regions that are becoming hotter and drier as a result of climate change. Rewriting the core workings of a plant is not a trivial task. But Voytas says Talens could be a valuable tool—both to identify the genetic pathways that might be tweaked and to make the many necessary genetic changes. The pressure to help feed the growing population at a time when climate change is making more land marginal for agriculture is “the burden that plant biologists bear,” Voytas says. But he’s optimistic. Over much of the last 50 years, he points out, crop productivity has made repeated gains, attributable first to the use of hybrid seeds, then to the new plant varieties introduced during the so-called Green Revolution, and “even to the first GM plants.” The introduction of the new genome engineering tools, he says, “will be another inflection point.” If he’s right, it might be just in time. Heat Wave For agronomists, plant breeders, and farmers, it’s all about yield—the amount a crop produces in a hectare. The remarkable increases in crop yields beginning in the middle of the 20th century are the main reason that we have enough food to go from feeding three billion people in 1960 to feeding seven billion in 2011 with only a slight increase in the amount of land under cultivation. Perhaps most famously, the Green Revolution spearheaded by the Iowa-born plant pathologist and geneticist Norman Borlaug substantially increased yields of wheat, corn, and rice in many parts of the world. It did so, in part, by introducing more productive crop varieties, starting in Mexico and then in Pakistan, India, and other countries. But for at least the past decade, increases in the yields of wheat and rice seem to have slowed. Yields of wheat, for example, are growing at roughly 1 percent annually; they need to increase nearly 2 percent annually to keep up with food demand over the long term. Agricultural experts warn that yields will have to improve for other crops as well if we are to feed a rapidly growing population—and yet rising temperatures and other effects of global climate change will make this tougher to achieve.